CLAIMS

1. A method for determining the flow rates of a fluid comprising a multi-component mixture of a gas and at least one liquid in a pipe, the method comprising the following steps:
    a. electromagnetic loss and phase measurements are performed in at least two directions of the pipe,
    b. the degree of annular flow is determined based on the measurements of step a,
    c. the permittivity of the flow mixture is calculated based on the results from steps a and b including correction for the degree of annular flow,
    d. the mixture density is measured and compensated for the degree of annular flow,
    e. the temperature and pressure are obtained,
    f. the velocity of liquid and gas are determined, and
    g. based on the knowledge of densities and permittivities of the components of the fluid mixture, and the result from the above steps a-f, the volume and mass flow rates of the gas and liquid or liquids of the fluid mixture are calculated.
2. A method according to claim 1, wherein the composition of the multiphase flow also is determined.
3. A method according to claim 1, wherein the electromagnetic measurements are performed in the cross sectional and longitudinal direction of the pipe.
4. A method according to any one of claims 1-3, wherein the electromagnetic measurements are performed by doing a frequency sweep on a transmitting antenna in the flowing fluid and recording the frequency at at least three pre-determined phase differences on two receiving antennas in the flowing fluid.
5. A method according to claim 4, wherein that in step b, the degree of annular flow is determined based on the distribution of the recorded frequencies.
6. A method according to any one of claims 1 – 4, wherein that in step b, the degree of annular flow is determined based on at least two different measurements of the permittivity in the flowing fluid that are differently influenced by the degree of annular flow.
7. A method according to claim 4, wherein that in step b, the degree of annular flow is determined based on the measured power difference on the received antennas.

8. A method according to any one of claims 1-7, wherein the liquid and gas velocity are measured by cross correlating measurements performed at two sets of antennas in the flowing fluid located at a known distance from each other.
9. A method according to any one of claims 1-8, wherein the density of the fluid mixture is measured utilising γ-ray absorption techniques.
10. A method according to any one of claims 1-8, wherein the density of the fluid mixture is measured using a venturi.
11. A method according to claim 10, wherein the pressure recovery at the outlet of the venturi is measured.
12. A flow meter for determining the flow rates of a fluid comprising a multi-component mixture of a gas and at least one liquid in a pipe, the flow meter comprising a tubular section and the following elements:
    a. means for performing electromagnetic loss and phase measurements in at least two directions of the tubular section,
    b. means for determining the degree of annular flow based on the above measurements including a suitable data model,
    c. a computer and a mathematical program for calculating the permittivity of the flow mixture based on the results from elements a and b above, including correction for the degree of annular flow,
    d. means for determining the mixture density and compensating it for the degree of annular flow,
    e. means for determining the velocity of liquid(s) and gas,
    f. means for determining the temperature and pressure, and
    g. means for calculating the volume and mass flow rates of the gas and liquid or liquids of the fluid mixture based on the information from the elements a-f and knowledge of densities and permittivities of the components of the fluid mixture.
13. A flow meter according to claim 12, wherein the tubular section comprises one transmitting antenna and two receiving antennas located in the same cross section of the tubular section and one transmitting antenna and two receiving antennas spaced in the longitudinal direction of the tubular section.
14. A flow meter according to claim 13, comprising electronic means for transmitting a frequency sweep on one transmitting antenna at the time and recording phase difference and loss for the frequency sweep on two of the receiving antennas.

15. A flow meter according to claim 14, comprising means for calculating the degree of annular flow based on the recorded phase difference and /or loss.
16. A flow meter according to claim 14, comprising means for calculating the degree of annular flow based on permittivity measurements in the cross section and longitudinal direction of the tubular section.
17. A flow meter according to any one of claims 12-16, comprising a device in the tubular section for reflecting electromagnetic waves in the longitudinal direction of the tubular section.
18. A flow meter according to any one of claims 13 – 17, comprising means for calculating the liquid and gas velocities by cross correlating measurements performed at two sets of antennas placed in different cross sections of the tubular section located a predetermined distance from each other.
19. A flow meter according to any of the claims 12-18, comprising a densitometer based on γ-ray absorption for measuring density of the fluid mixture.
20. A flow meter according to claim 18, comprising means for calculating the density of the fluid mixture based on measurement of pressure drop of a venturi.
21. A flow meter according to claim 20, comprising means for measuring the pressure recovery at the outlet of the venturi.